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PROCEEDINGS  
OF THE  
CALIFORNIA ACADEMY OF SCIENCES

FOURTH SERIES

Vol. XL, No. 5, pp. 93-107; 4 figs.

February 18, 1975

TWO NEW BLIND SNAKES (SERPENTES:  
LEPTOTYPHLOPIDAE) FROM BAJA  
CALIFORNIA, MEXICO WITH A  
CONTRIBUTION TO THE  
BIOGEOGRAPHY OF  
PENINSULAR AND  
INSULAR HERPETOFAUNA

By

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ABSTRACT: Two new subspecies of *Leptotyphlops humilis* from the Gulf of California, Mexico are described. Biogeographical theories explaining the distribution of the herpetofauna of southern insular and peninsular Baja California, Mexico are reviewed. Recent developments in continental drift form the basis of a new interpretation of the distribution of the isolated forms.

Recently two specimens of *Leptotyphlops* which appear to belong to *L. humilis* were received by the California Academy of Sciences. They were collected on Isla Santa Catalina, Gulf of California, Mexico by Bruce Feldhammer in March, 1972. These specimens are of considerable interest because they are the first records for the genus from Isla Santa Catalina which has a highly endemic herpetofauna. Of ten reptiles known on the island, all are endemic, so it is not surprising to find that this is indeed the case for these blind snakes. Another insular representative of *Leptotyphlops* was reported by Soulé and Sloan in 1966. They assigned a single specimen of *L. humilis* from Isla Carmen with seven pigmented rows of median dorsal scales to *L. h. slevini*, a subspecies described by Klauber (1931) as having only five lightly or moderately colored

dorsal scale rows. Re-examination of the Soulé-Sloan specimen showed this blind snake to be so unique that reference to a distinct taxon seems justified. I take pleasure in naming the Santa Catalina population for Dr. Alan E. Leviton who has provided me the opportunity to study at the California Academy of Sciences. The Isla Carmen population is named in honor of Dr. George E. Lindsay who, as former Director of the San Diego Society of Natural History and current Director of the California Academy of Sciences, has played a most important role in biological research in Baja California.

The following abbreviations are used in this paper: CAS—California Academy of Sciences; CAS-SU—California Academy of Sciences—Stanford University Collection; LACM—Los Angeles County Museum of Natural History; MVZ—Museum of Vertebrate Zoology, University of California, Berkeley; SDSNH—San Diego Society of Natural History.

### ***Leptotyphlops humilis levitoni*** Murphy, new subspecies.

Santa Catalina Island Blind Snake.

(Figure 1.)

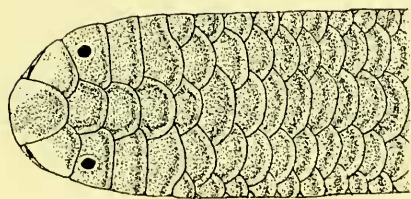
HOLOTYPE. CAS 135146, adult, from Isla Santa Catalina, Gulf of California, Mexico [ $26^{\circ} 40' N.$ ,  $110^{\circ} 47' W.$ ], collected by Bruce Feldhammer on 24 March 1972.

PARATYPE. CAS 135147, adult, same locality data as the holotype.

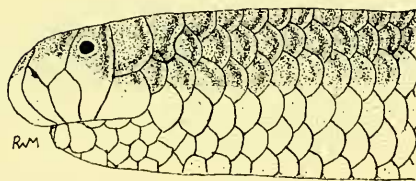
DIAGNOSIS. A subspecies of *Leptotyphlops humilis* (Baird & Girard) having a low dorsal scale count, seven pigmented scale rows, 12 scale rows around the tail, a low number of subcaudal scales, and no pigmentation around the mouth.

DESCRIPTION. Snout bluntly rounded; rostral elongate and wedge-shaped with widest point at level of nostrils, in contact with nasals and prefrontal; nasals completely divided; lower nasal elongate, wider dorsally, completely separating rostral and anterior supralabial; upper nasal elongate, wider ventrally, in contact with ocular, rostral, lower nasal, and prefrontal; single anterior supralabial with dorsal edge acutely terminating at lower level of eye; large ocular extending from central dorsal row to the mouth and completely separating supralabials; eye anterior in upper half of ocular; occipital and parietal elongate with the latter in contact with posterior supralabial; temporal smaller than other postoccipitals. First four dorsal median scales are hexagonal, almost as long as broad with approximate order of increasing size being 2nd-1st-4th-3rd; fifth dorsal median scale slightly broader than all others. Head widest at occipitals. Four infra-labials, anterior being minute (easily confused with mental) and posterior being largest. Mental very small, approaching triangular shape. Chin shields irregular, blending with ventrals at level of parietals.

Body almost cylindrical; head slightly distinct, narrower than mid-body diameter; tail slightly but distinctly diminished in diameter and terminating in



A



B

FIGURE 1. *Leptotyphlops humilis levitoni* Murphy, new subspecies. A. Dorsal view of head. B. Lateral view of head.

a laterally compressed sharp spine. Body scales equal in size without conspicuously enlarged dorsal or ventral scales.

Ground color (in 75% ethanol) of cinnamon or medium dark brown present on seven median dorsal scale rows; pigmentation sometimes involves as few as five rows anteriorly and as many as nine posteriorly. Pigmentation is applied evenly as a multiplicity of dots with a greater density on the terminal edge of each pigmented scale. An area surrounding the mouth lacks pigmentation, except for occasional spots, and includes: anterior two-thirds of rostral; lower nasals; lower one-fourth of the upper nasals; anterior supralabials; lower portion of the ocular and posterior supralabials from a line beginning at the top of the anterior supralabial to the angle of the jaw. Infralabials, mental, and chin shields lack pigmentation. Ventral color varies from light brown in the anterior half to cream in the posterior half.

MEASUREMENTS. Total length 212 mm.; tail length 9.6 mm.; body diameter 5.1 mm.; tail length into total length 23.1; average body diameter into total length 42.8. Fourteen scale rows around the body; 12 scale rows around the tail; 249 dorsal scales from rostral to spine; 14 subcaudal scales; anal plate not divided.

RANGE. Known only from type locality.

PARATYPE. The single paratype, an adult, adheres closely to the description of the holotype. Total length 214 mm.; tail length 8.5 mm. (tail somewhat constricted); body diameter 4.8 mm.; tail length into total length 25.2; average

body diameter into total length 43.2. Fourteen scale rows around the body; 12 scale rows around the tail; 250 dorsal scales from rostral to spine; 14 subcaudal scales. The first four dorsal scales are hexagonal, almost as long as broad with approximate order of increasing size being 1st-2nd-3rd and 4th. Coloration is identical to the holotype.

REMARKS. A blind snake of the species *Leptotyphlops humilis* (Baird & Girard) which differs from *L. h. humilis*, *L. h. cahuilae*, *L. h. utahensis*, and *L. h. segregus* in having fewer dorsal scale rows; from *L. h. slevini* and *L. h. cahuilae* in having 7 pigmented median dorsal scale rows; from *L. h. segregus* and *L. h. tenuiculus* in having 12 scale rows around the tail; and from *L. h. dugesi* in having fewer subcaudals and no pigmentation around the mouth.

*Leptotyphlops h. levitoni* appears to be most closely allied to *L. h. dugesi*, and on the basis of the number of dorsal scales, to *L. h. slevini*. However, the character of the number of dorsal scales may be misleading. Fox (1948) showed that temperature may be a major factor in determining the number of scales of *Thamnophis couchi* (= *elegans*) *atratus*. One may observe a similar situation in *Leptotyphlops humilis*, for the number of dorsal scales appears to increase in specimens from south to north (or warm to cold). This trend was noted first by Klauber (1940) and again by Hardy and McDiarmid (1969).

### ***Leptotyphlops humilis lindsayi* Murphy, new subspecies.**

Lindsay's Blind Snake.

(Figure 2.)

*Leptotyphlops humilis slevini* KLAUBER (part), 1966, Trans. San Diego Soc. Nat. Hist., vol. 14, no. 11, pp. 137-156.

HOLOTYPE. SDSNH 44386, adult female from Isla Carmen, Gulf of California, Mexico [25° 57' N., 111° 12' W.], collected by Charles E. Shaw and George E. Lindsay on 4 April 1962.

DIAGNOSIS. A subspecies of *Leptotyphlops humilis* (Baird & Girard) having a low dorsal scale count, seven pigmented median dorsal scale rows, 12 scale rows around the tail, low number of subcaudal scales, and pigmented supralabials.

DESCRIPTION. Head widest behind occipital; snout bluntly rounded; rostral elongate, widest point at level of nostril, in contact with nasals and prefrontal and terminating at anterior level of eye; lower nasal elongate, wider dorsally, completely separating rostral and anterior supralabial; upper nasal longer than wide with greatest width at level of eye, in contact with ocular, rostral, lower nasal, and prefrontal; single anterior supralabial with dorsal edge acutely terminating; large ocular extending from central dorsal scale row to the mouth, completely separating anterior and posterior supralabials; eye anterior in center of ocular; occipital and parietal elongate with latter in contact with posterior

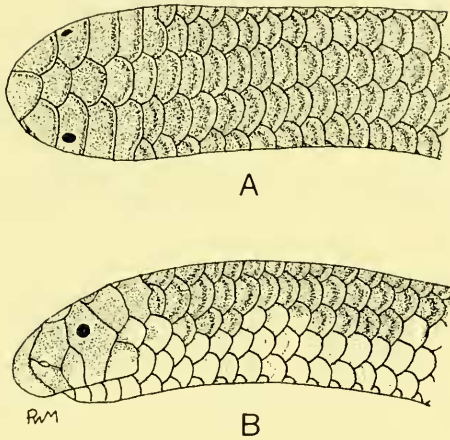


FIGURE 2. *Leptotyphlops humilis lindsayi* Murphy, new subspecies. A. Dorsal view of head. B. Lateral view of head.

supralabial: first three postoculars as elongate scales on right side, first two elongate on left side; temporals smaller than body scales. First four dorsal median scales hexagonal, almost as long as broad and nearly equal in size; fifth dorsal median scale not greatly enlarged. Four infralabials, anterior being greatly reduced, posterior being largest; mental very small, almost triangular in shape; chin shields irregular anteriorly, blending with ventrals behind head.

Body nearly cylindrical, head only slightly distinct; tail slightly, but distinctly, diminished in diameter and terminating in a laterally compressed sharp spine. Body scales equal in size without conspicuously enlarged dorsal or ventral scales.

The ground color (in 75% ethanol) of sayal or medium brown is usually present on seven dorsal median scale rows and occasionally involves as few as five anteriorly and as many as nine posteriorly. Body pigmentation is evenly dispersed as a multiplicity of dots except at the terminal edge of the scales where pigmentation appears denser; lateral rows may appear lighter than dorsal rows. Other body scales are varying shades of cream. Head pigmentation is as follows: posterior one-half of rostral; right lower nasal slightly pigmented; left lower nasal; upper nasals; dorsal one-half of anterior supralabials; oculars; dorsal and anterior portion of posterior supralabials; all dorsal scales. The lower jaw is void of pigmentation.

MEASUREMENTS. Total length 202 mm.; tail length 8 mm.; body diameter 4.9 mm. (may be small since the body cavity is completely opened); tail length into total length 25.3; body diameter into total length 41.2. Fourteen scale rows around the body; 12 scale rows around the tail; 243 dorsal scales from rostral to spine; 14 subcaudal scales; anal plate not divided.



RANGE. Known only from type locality.

REMARKS. A blind snake of the *Leptotyphlops humilis* (Baird & Girard) complex differing from *L. h. humilis*, *L. h. cahuilae*, *L. h. utahensis*, and *L. h. segregus* in having fewer dorsal scales; from *L. h. slevini* and *L. h. cahuilae* in having seven pigmented median dorsal scale rows; from *L. h. segregus* and *L. h. teniculus* in having 12 scale rows around the tail; from *L. h. levitoni* in having pigmented upper lips; and from *L. h. dugesi* in having fewer subcaudals and no pigmentation in lower labials of adults.

One characteristic of *L. h. lindsayi* appears unique. The enlarged right third postocular (or postoccipital) has not been reported for any other subspecies of *L. humilis*. The occurrence of this phenotypic expression within a genetically isolated population seems significant.

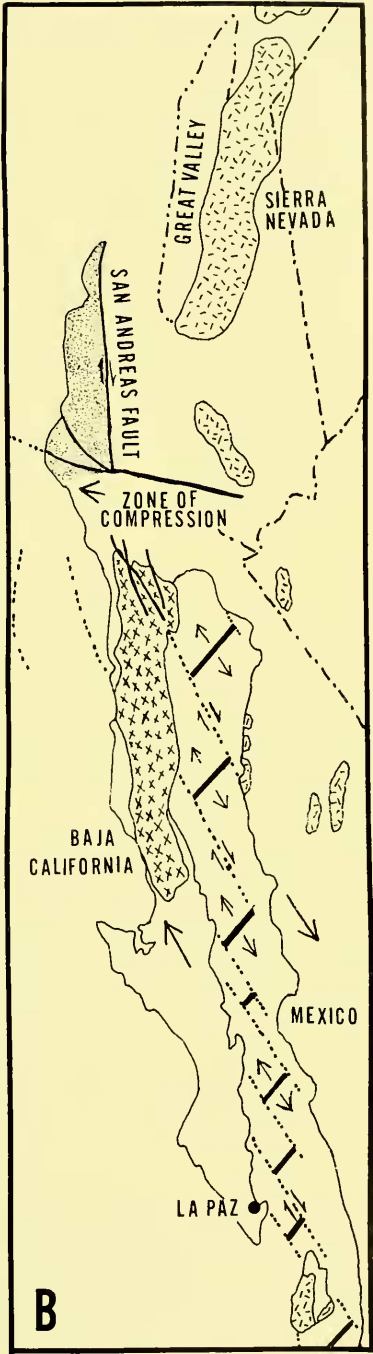
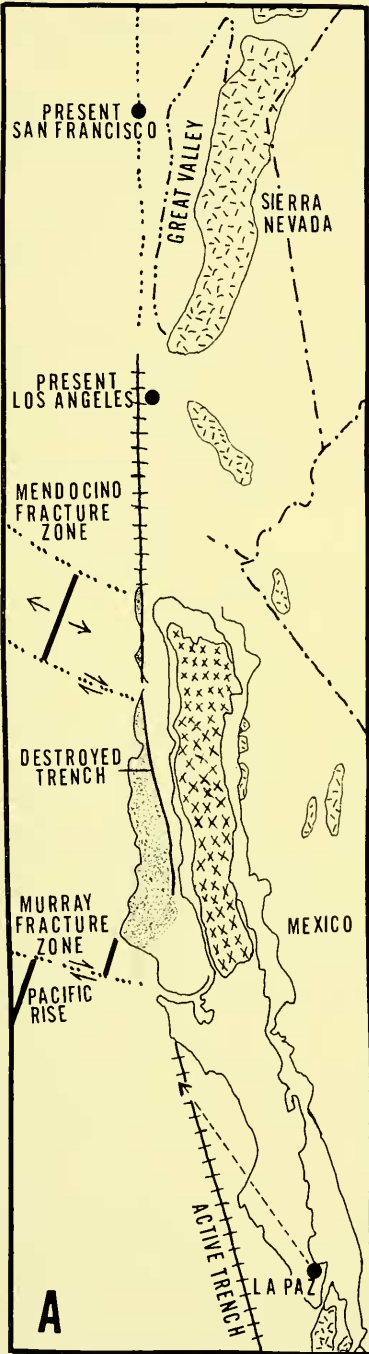
In other characteristics, *Leptotyphlops h. lindsayi* is allied to *L. h. levitoni* and *L. h. dugesi*. Similarity between these three forms is seen in low dorsal scale counts, coloration, and similarity of scale patterns.

#### DISCUSSION

Savage (1960) presented a detailed hypothesis of southern peninsular Baja California invasion by northern herpetofaunal forms. According to Savage, immigration of northern forms, which presumably began in the Pliocene and occurred in four successive waves, replaced the early Tertiary fauna of the area. Savage contended that the first Pliocene wave ultimately formed the basic modern fauna of the Californian and San Lucan areas. A second wave of desert-adapted groups invaded the northern areas as aridity increased during the end of the Pliocene, while at the beginning of the Pleistocene a third wave invaded the northern portion of the peninsula as general temperature drops occurred; this third cluster produced the desert forms of the east and south peninsula. Finally, in the Pleistocene, the fourth or possibly several waves of desert forms invaded from the northeast at times of interglacial conditions. Overlap of San

→

FIGURE 3. Early and late stages in the history of the San Andreas fault. A. twenty-five million years ago Baja California presumably nestled against mainland Mexico. The first section of oceanic rise between the Murray fracture zone and the Pioneer fracture zone has just collided with the continent. Trench deposits are uplifted and become part of the Coastal Ranges of California. The block containing the present San Francisco area (stippled) is about to start its long northward journey. A block immediately to the east (cross-hatched) becomes attached to the Pacific plate and eventually is jammed against the San Bernardino Mountains. B. Three million years ago the Gulf of California has started to open. As the peninsula moves away from mainland Mexico a series of rifts appear, fill with magma, and are offset by numerous fractures. Baja California may have been torn off in one piece or in slivers. (Reprinted from Anderson, *The San Andreas Fault*. Copyright © 1971 by Scientific American, Inc. All rights reserved.)



Lucan forms moving north and the northern forms moving south then occurred in the central peninsula.

The plate tectonic conception of continental drift was founded in the late 1950's. Many American scientists were reluctant to accept the concept until the late 1960's (Wilson, 1972). This may account for the fact that Savage failed to include the distribution and origin of the insular faunas, which could not be readily explained by his northern origins hypothesis. Thus, Savage overlooked one important possibility, that much of the San Lucan and insular herpetofauna did not arrive by Pliocene and Pleistocene invasion from the north but rather by traversing the Gulf on the Peninsula as the latter broke away from mainland Mexico. In fact, Streets, in 1877 (pp. 41-42), suggested ". . . geological changes . . . since the post-Tertiary period," to explain the insular occurrence of reptiles on Pacific and Gulf islands. This concept is best exemplified by the presence of *Bipes biporus*, *Natrix valida celaeno*, *Ctenosaura hemilopha*, *Pseudemys scripta nebulosa*, and *Eridiphas slevini*, the latter possibly representing a link between *Leptodeira* and *Hypsiglena* (Leviton & Tanner, 1960).

Since the discussion by Savage (1960), Anderson (1971) evaluated current information on the San Andreas Fault and presented his "Two-fault hypothesis" (fig. 3). According to Anderson, before the Pacific plate began moving northwest the "San Francisco" area was located near the present location of Ensenada in northern Baja California and present day "Baja California" presumably nestled against mainland Mexico. Twenty-five million years ago the northern Pacific plate separated from Bahia Sebastian Vizcaino (near Scammon's Lagoon) and began its northwest journey of up to 700 miles. Twenty million years later (four to six million years ago) the southern portion of the Pacific plate was torn from mainland Mexico forming the Gulf of California. Eventually, after 300 miles of northwest migration, the southern Pacific plate rammed into the northern Pacific plate and formed a single unit. It should be noted that the peninsula may have split from mainland Mexico in several fragments. Anderson (1971, p. 60), in illustrating the early and late stages of the history of the San Andreas Fault, pictures the southern tip of Baja California as being a separate land mass as late as three million years ago (fig. 3).

Auffenberg and Milstead (1965) noted that very little taxonomic differentiation occurred between the Pliocene and Recent, particularly at the species level. They further state that the greatest effects of the Pleistocene on Baja California were those of changes in sea-level and not climatic change. The sea-level changes (such as a drop of approximately 110 meters and estimated rise of 30 meters [Flint, 1971]) had little effect on Baja California topography except for creating and drowning many islands (Durham & Allison, 1960). On this basis Soulé and Sloan (1966) placed many islands in a category of probable recent or young shallow-water islands, including therein Tiburon, San Marcos,



Coronados, San Jose, San Francisco, and Espiritu Santo as well as many small coastal and satellite islands and possibly Carmen, Monserrate, and Danzante (fig. 4).

In view of recent information and concepts, it is possible to suggest the following interpretation of the distribution and interrelationships of the forms of *Leptotyphlops humilis*. Prior to the separation of Baja California from mainland Mexico *L. humilis*, as well as many other forms of reptiles and amphibians, occurred in both areas. The southern Pacific plate began moving northwest and carried the blind snakes with it. The Cape San Lucan region parted from mainland Mexico, possibly from a location further south, as a separate unit, free of the peninsula, and remained isolated until mid-Pleistocene. The population of *L. humilis* isolated on this island evolved into a group having only five pigmented median dorsal scale rows. This group is presently known as *L. h. slevini*. As the peninsula was torn away from mainland Mexico two southern groups of islands were formed and have remained without further contact: Isla Santa Catalina and islas San Diego and Santa Cruz. Evidence for this is the high percentage of endemic reptiles present on these islands. If these islands had had recent contact with the mainland, then mainland forms would be expected to occur. In addition, the existence of *Crotalus catalinensis*, allied to *C. atrox* (Klauber, 1956, 1972), on Isla Santa Catalina and *C. atrox* on Isla Santa Cruz is better explained by continental drift than by the swimming or rafting suggested by Klauber (1956, 1972). *Sator angustus*, which occurs on San Diego and Santa Cruz presents the same problem [see below]. *Leptotyphlops humilis* is presently known from one of these "old" islands, Isla Santa Catalina.

Another group of islands was formed later. During the Pleistocene, tectonic shifts and sea-level changes formed the young, shallow-water islands (as noted earlier) including Carmen, Monserrate, and Danzante. These islands share a large percentage of their herpetofauna with the Baja California mainland. During Pleistocene glaciation and lower water-levels, reptiles could easily pass from the peninsula to these islands. There is evidence that some of these islands have undergone recent uplifting (Anderson, 1950; Wilson & Rocha, 1955; Soulé & Sloan, 1966) indicating recent faulting and instability. If this dual theory of island formation is true then *L. h. levitoni* has remained isolated from the parental stock since mid-Pliocene, *L. h. lindsayi* being isolated sometime during the Pleistocene.

The presence of *Sator grandaevus* on Isla Cerralvo and its absence from the San Lucan region of mainland Baja California has been a subject for interesting speculation for a long time. On those islands on which *Sator* occurs, no other sceloporine lizards are known. The occurrence of the old southern forms of reptiles, as *Eridiphas slevini*, on both Isla Cerralvo (Soulé, 1961) and the southern tip of mainland Baja California, would seem to indicate that these two regions had

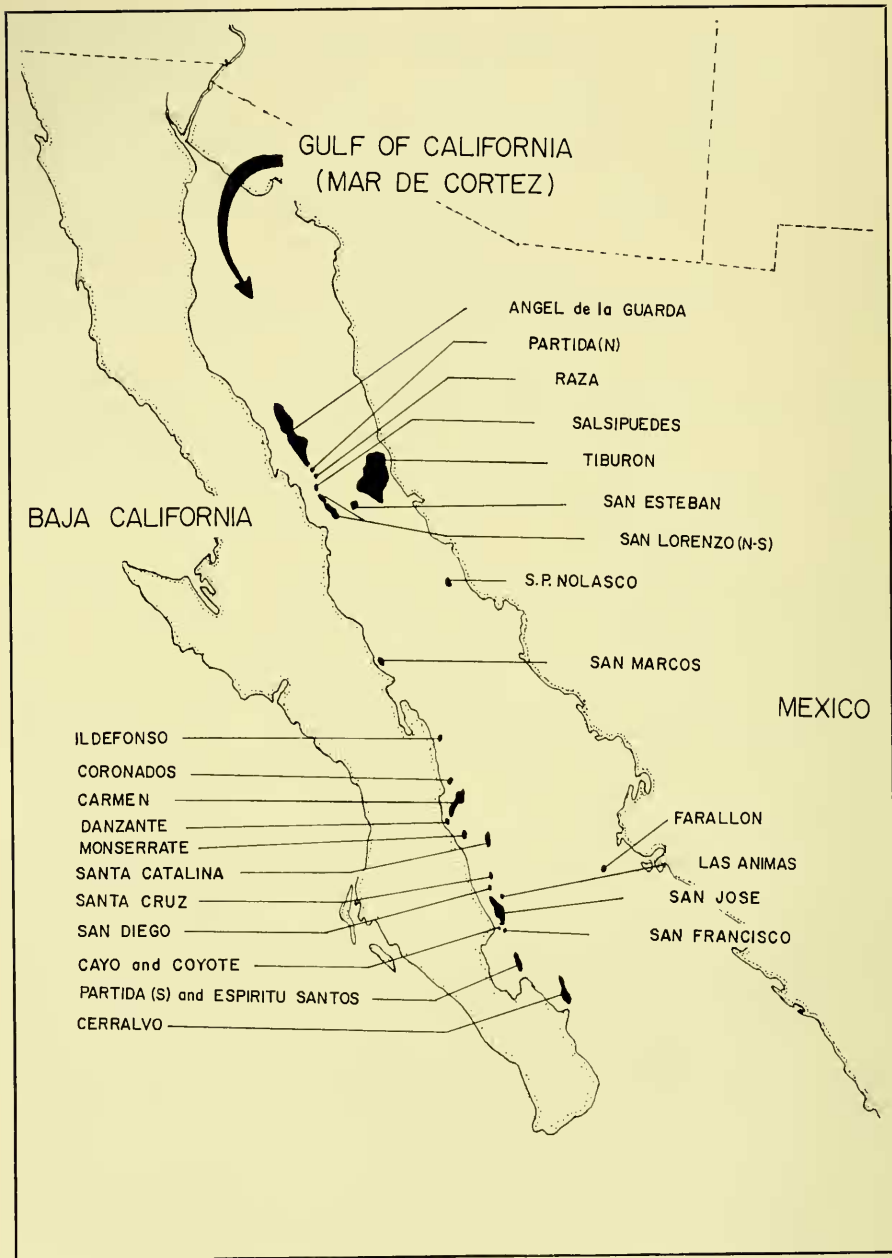


FIGURE 4. A map of the Gulf of California indicating the islands discussed in this paper.

a similar origin. Seemingly, Isla Cerralvo was separated from the San Lucan region before the San Lucan plate joined with the southern Pacific plate in the mid-Pleistocene. When these two plates joined, the sceloporine lizards of the north invaded the San Lucan region and pressured the San Lucan form of *Sator* to extinction. After the San Lucan plate joined the Pacific plate, the sea-level dropped briefly allowing invasion of Isla Cerralvo by northern iguanids. However, the length of time for invasion was not sufficient to allow invading sceloporines to overrun the Cerralvo populations of *Sator*. Islas San Diego and Santa Cruz may have had a similar southern origin and have been moving northwest since the San Lucan plate rammed the southern Pacific plate.

The relationships between Isla Cerralvo and islas San Diego and Santa Cruz have never been understood. If these islands had a similar southern origin, and if they were only recently separated, it seems reasonable to expect that any *Leptotyphlops* discovered would be of similar origin and therefore would have only five pigmented median dorsal scale rows. Unfortunately, we have no evidence at this time to test this speculation.

*Leptotyphlops humilis slevini*, as mentioned earlier, was long separated from other populations of *L. humilis*. By the time the San Lucan plate joined the rest of the peninsula, the local population of *L. humilis* had undergone a substantial change, that of reduction in the number of pigmented median dorsal scale rows. The occurrence of this subspecies on Isla Cerralvo (Banks & Farmer, 1963) provides further evidence that this island is part of the San Lucan plate.

Only one other subspecies, *L. h. cahuilae*, is known to have five pigmented median dorsal scale rows. Klauber (1940) postulated that the Sonoran *L. h. cahuilae* became isolated for a considerable length of time, possibly by Lake Cahuilla, and then remet and interbred with *L. h. humilis*. He also noted that different desert-dwelling populations of *L. h. cahuilae*, as that of the Vizcaino Desert in central Baja California, either evolved parallelly with Sonoran *L. h. cahuilae* or represent a residue of a former intrusion from Sonora. Continental drift adds two additional possibilities: either the Vizcaino Desert population traversed the gulf or immigrated from the south. Two specimens of *L. h. cahuilae* (CAS 103465 and LACM 2167) from Bahia de Los Angeles, Baja California Norte, [28° 55' N., 113° 32' W.], indicate that the ranges of Sonoran and Vizcaino Desert *L. h. cahuilae* are continuous. Seemingly this would eliminate Klauber's anticipation of the isolated Vizcaino Desert population. However, current data are not adequate to determine the "*slevini-cahuilae*" subspecies relationships.

Of the nine subspecies of *L. humilis* currently recognized two are definitely allied; *L. h. utahensis* is certainly derived as a northern extension of *L. h. humilis*, *L. h. utahensis* being distinct in having a divided fourth and an enlarged fifth anterior median dorsal scale. The occurrence of five *L. h. humilis* × *utahensis* intergrades (CAS 89570, 89577, 89591–89593) from Inyo County,

California extends the expected range of intergradation, as predicted by Klauber (1940), by approximately 100 miles.

As noted earlier, *L. h. dugesi*, *L. h. levitoni*, and *L. h. lindsayi* also appear to be quite closely related for all three share the characteristics of a low number of dorsal scales, 12 scale rows around the tail, a low ratio of body length to body diameter, 7 pigmented median dorsal scale rows, and a medium to dark brown coloration. *L. h. slevini* shares some of these characteristics but differs in having 5 pigmented median dorsal scale rows and a light brown coloration. Based on the transgulfian migration theory, *L. h. slevini* forms a unique taxon within the *L. humilis* complex and, though closely related, is not a member of the "*dugesi-levitoni-lindsayi*" combination.

In their discussion of the biogeography and distribution of the herpetofauna on the islands in the Gulf of California Soulé and Sloan (1966) commented on two trends of insular reptiles; gigantism in lizards and dwarfism in snakes (with noted exceptions). The ratio of body length to body diameter for *L. h. levitoni* and *L. h. lindsayi* is less than those of any other subspecies of *L. humilis*. Such a low ratio of body length to body diameter indicates that the two insular worm snakes have heavier bodies than their mainland relatives. Once the population structure is better known these statistics can be further interpreted as being attributable to gigantism, an effect of dwarfism, or the result of insufficient data.

A REVISED KEY TO THE SUBSPECIES OF THE WESTERN BLIND SNAKE,  
*LEPTOTYPHLOPS HUMILIS*

- |  |   |
|--|---|
| 1a. Five pigmented dorsal median scale rows .....  | 2   |
| b. Seven to nine pigmented dorsal median scale rows .....  | 3   |
| 2a. Dorsal scale rows less than 270; Cape region of Baja California Sur; Isla Cerralvo, Gulf of California, Mexico .....                                 |   |
| b. Dorsal scale rows more than 280; central Baja California north to southern California and Arizona; northern Sonora, Mexico .....                      | <i>L. h. slevini</i> Klauber<br><i>L. h. cahuilae</i> Klauber |
| 3a. Ten scale rows around tail .....   |   |
| b. Twelve scale rows around tail .....   |   |
| 4a. Dorsal scale rows less than 250; San Luis Potosi .....   |   |
| b. Dorsal scale rows more than 250; central Coahuila, Mexico north to southeastern Arizona and through trans-Pecos Texas .....                           |   |
| 5a. Dorsal scale rows more than 280; fourth mid-dorsal scale often divided; fifth dorsal much wider than sixth; southwestern Utah .....                  |   |
| b. Dorsal scale rows less than 280; fifth mid-dorsal scale not much wider, if any, than sixth .....  |   |
| 6a. Dorsal scale rows greater than 257; central Baja California, Mexico north to southern Nevada southeast to south-central Arizona; Cedros Island ..... |   |
| b. Dorsal scale rows less than 257 .....   |   |

- 7a. Lower nasals pigmented ..... 8  
 b. Lower nasals not pigmented; Isla Santa Catalina, Gulf of California, Mexico .....  
 ..... *L. h. levitoni* Murphy
- 8a. Subcaudals 15 or less; infralabials not pigmented in adults; Isla Carmen, Gulf of California, Mexico ..... *L. h. lindsayi* Murphy
- b. Subcaudals usually more than 15; infralabials of adults often pigmented; southern Sonora southeast to Colima; Guanajuato, Mexico ..... *L. h. dugesi* (Bocourt)

## MATERIAL EXAMINED

*L. h. cahuilae* (13). CALIFORNIA. Imperial Co.: 5 mi. N. Winterhaven (MVZ 63562); Riverside Co.: Palm Springs, China Canyon (MVZ 71090). ARIZONA: Yuma Co., (CAS-SU 5697). MEXICO. BAJA CALIFORNIA DEL NORTE: 5 mi. N. San Felipe, Playa del Sol Camp (CAS 136368-136369); 6 mi. N. San Felipe (LACM 36504); Punta San Felipe,  $\pm$  50 ft. (MVZ 50168); Bahía de Los Angeles (CAS 103465, LACM 2167); Sierra Juarez (CAS 85069); Base of grade below Alaska (CAS-SU 11567); San Jose, 2300 ft. (MVZ 9637). SONORA: 56 mi. E. San Luis (LACM 9033).

*L. h. dugesi* (12). MEXICO. SINALOA: Mazatlan (CAS-SU 1776); 11 mi. N. Culiacan (LACM 6773); 20 mi. S. Culiacan, Mexico Highway 15 (LACM 51564); 0.5 mi. N. Terroros (LACM 6773). NAYARIT: Tepic, LaLoma Motel (CAS-SU 19243); 5 mi. E. Santa Cruz (CAS 134054); between San Blas and Mexico Highway 15 (LACM 8730-8731); 18.5 mi. E. (by road) San Blas (MVZ 71333). JALISCO: Jocotepec (CAS 85470); 14.5 mi. E. Tapalpa (LACM 37327-37328).

*L. h. humilis* (28). CALIFORNIA. San Diego Co.: (CAS 58160, 62992, 64442); Palomar Mountain (CAS 58132); Ladrillo Station (Rose Canyon, CAS 53933); Scissors Crossing, Highway 78 (MVZ 64478); 1.2 mi. E. Scissors Crossing (CAS-SU 19763); 2 mi. E. Scissors Crossing (CAS-SU 19766); 0.5 mi. E. Scissors Crossing (CAS-SU 19764-19765); 1 mi. ENE. Scissors Crossing, 2200 ft., San Felipe Valley (MVZ 79215); Lemon Grove (MVZ 10189). San Bernardino Co.: 9 mi. W. Earp (MVZ 51268); Twenty-nine Palms (MVZ 56491). Inyo Co.: Inyo Mountains, N. side of Daisy Canyon, 3900 ft. (CAS 89594); Nelson Mountains, Grapevine Canyon, 4500 ft. (CAS 89568). Los Angeles Co.: near mouth of Big Santa Anita Canyon (MVZ 74653). Riverside Co.: mouth of Whitewater Canyon, E. canyon wall (MVZ 80920). ARIZONA. Pima Co.: Tucson (CAS 33525, 33835-33836, 91533); Santa Catalina Mountains (CAS 35849). Pinal Co.: S. Florence Junction (CAS 84135). MEXICO. BAJA CALIFORNIA DEL NORTE: San Ignacio, 500 ft. (MVZ 10667); 15 mi. E. San Telmo de Arriba (CAS 123717); 7 mi. S. Tecate (CAS 134800). CHIHUAHUA: 3 mi. NW. Chilmahma, 0.5 mi. W. main highway (MVZ 57331).

*L. h. levitoni* (2). MEXICO. Gulf of California, Isla Santa Catalina (CAS 135146-135147).

*L. h. lindsayi* (1). MEXICO. Gulf of California, Isla Carmen (SDSNH 44386).

*L. h. slevini* (16). MEXICO. BAJA CALIFORNIA SUR: Gulf of California, SW. side of Isla Cerralvo (CAS 93009); La Paz (CAS 129644-129645, 134772-134223; MVZ 45386; LACM 25061); 7 km. S. La Paz (CAS 134801-134802); Eureka (MVZ 11850-11851); San Jose del Cabo (CAS-SU 4118, paratype); vicinity of Cabo San Lucas (CAS-SU 14032-14033); Santa Anita (CAS-SU 6025); vicinity of Cape San Lucas (CAS-SU 16061).

*L. h. humilis*  $\times$  *cahuilae* intergrades (191). CALIFORNIA. Imperial Co.: Colorado River, Laguna Dam (MVZ 63543-63548, 63550-63556, 63560-63561, 70457); Laguna Dam, Laguna



Island (MVZ 105162-105172, 85237-85238, 93113, 93115); Laguna Dam, Potholes (MVZ 63549, 50228-50233; CAS 80392-80459, 80461-80468, 80470-80532); 3 mi. S. Laguna Dam (MVZ 93114); about 15 mi. E. Glamis on Highway 78-S (MVZ 84701). Riverside Co.: 1 mi. SE. Cabazon, base of San Jacinto Mountains (MVZ 74652); 1.5 mi. ENE. Cabazon, base of San Jacinto Mountains (MVZ 74647-74651); Palm Springs, China Canyon (MVZ 70458). Inyo Co.: Death Valley, Coweruls, 4 mi. N. Furnace Creek Dam, 150 ft. (MVZ 19284); Death Valley, Cow Creek (MVZ 35360). San Bernardino Co.: Merango Valley, 4 mi. N. Riverside Co. line (MVZ 63571). MEXICO. SONORA: 136 mi. E. Mexicali, Mexico Highway 2 (LACM 20309); 23 mi. SSE. Sonoyta (LACM 25168-25169).

*L. h. humilis* × *utahensis* intergrades (5). CALIFORNIA. Inyo Co.: Nelson Mountains, Grapevine Canyon, 4630 ft. (CAS 89592-89593); Nelson Mountains, Grapevine Canyon, 4480 ft. (CAS 89570); Saline Valley, S. end, Racetrack Valley Road, 2100 ft. (CAS 89591); Saline Valley, S. end, Lower Grapevine Canyon, 4000 ft. (CAS 89577).

#### ACKNOWLEDGMENTS

I thank the following, and their institutions, for the use of specimens: Alan E. Leviton (California Academy of Sciences); David B. Wake and Steven B. Ruth (Museum of Vertebrate Zoology, University of California, Berkeley); Robert L. Bezy and John W. Wright (Natural History Museum of Los Angeles County); and Thomas H. Fritts (San Diego Natural History Museum). For editorial and typing assistance I thank my wife Wrennie Murphy and Christine M. Brennan. A special thanks to Jean Durham for her assistance in locating geologic and paleontologic references and to Ute L. von Doyen for her assistance in preparation of the maps. To both Alan E. Leviton and Lawrence W. Swan I am indebted for critical evaluation and suggestions. Credit for figure 3 should go to W. H. Freeman and Company who kindly granted permission to reproduce the figure from *Scientific American*, vol. 225, no. 5, p. 60.

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